A STIRLING IDEA

Super cool! Low temperature refrigerators, medical diagnostic equipment, and sophisticated electronics—all these are benefiting from cryocooling technology.

Stirling Technology Company (STC), Kennewick, Washington, designed a line of cryocoolers under Small Business Innovation Research (SBIR) contracts with Goddard Space Flight Center (GSFC) and Marshall Space Flight Center (MSFC).

Stirling engine technology is rooted in the creative tinkering of Scottish brothers, Robert and James Stirling. They invented the Stirling engine in 1816. STC has advanced Stirling engine technology, bringing it from the 1800s into the Space Age. These type engines are unparalleled in energy efficiency. They approach the limits set by the laws of thermodynamics more closely than any other power system. Stirling engines need less heat energy to generate a given power of output. Versatile in performance, Stirling engines can be reversed to make refrigerators, cryocoolers, or heat pumps. So efficient is the engine, it can chill to cryogenic temperatures.

GSFC awarded the SBIR funds to characterize spacecraft sensor/instrument cooling hardware, predicated on the high performance of a liquid helium temperature refrigeration system. STC culled together company talent in thermodynamic, dynamic, and mechanical design, producing for GSFC a low-temperature approach.

MSFC's needs were different. SBIR work for MSFC was geared toward a spacecraft food freezer/refrigerator. NASA requirements centered on a refrigerating unit that ran at a cooling potential or average freezer heat load of 115 thermal watts, and operated at a chilly temperature of -15 degrees Fahrenheit. An upgrade of the modular refrigeration unit is slated to be aboard the International Space Station. The innovative Stirling cycle refrigerator approach gave NASA a high performance, rugged, and quiet refrigerator system. Moreover, the system does not require ozone-depleting chlorofluorcarbons, better known as CFCs.

A new linear motor, invented by Dr. Syed Nasar from the University of Kentucky, proved key. The motor accommodated low-cost mass production assembly and fabrication techniques. STC tests and refinement of this motor design proved crucial in the commercialization of the cryocoolers.

The result? The BeCOOL™ line of low temperature refrigeration equipment that sports long life, low maintenance, high reliability, and attains high safety characteristics. All of these features combined to make the newest cryocooler hardware attractive for a variety of commercial applications, such as controlling computer temperature and for laboratory experiments. These attributes of STC's BeCOOL cryocoolers have a heritage based in the tough, technology-pushing prerequisites of NASA.

STC has been able to produce a high-capacity linear drive cooler, one with features that satisfy commercial demands. It has a demonstrated operation life exceeding 30,000 maintenance-free hours. The product will be initially sold to laboratories that require cryogenic refrigeration and for medical applications. The low noise level of the cooler permits its operation in work areas.

STC believes that niche markets are likely to evolve for power generators that are highly-efficient, reliable, maintenance-free, multifuel compatible and produce ultra-low emissions. Supported by company research funds, 10-watt and 350-watt power generators have been built. Multiple units have been sold to government and commercial customers for evaluation purposes. STC's forecast is a demand for turn-of-the-century generators that offer a capacity in the 3-kilowatt range.

Since incorporation in 1985, STC has received over $22 million in research and development contracts from both government and commercial clients. Successful completion of these contracts has enabled STC to design and build unique products, earning the company the reputation for providing long-life, maintenance-free, high-efficiency Stirling machines.

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Stirling Technology Company engineer readies the cryocooler. NASA requirements called for low-temperature equipment to run sensors to achieve refrigeration levels for a space-rated freezer.